METHOD FOR REDUCING IMAGE NOISE

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the priority benefit of Taiwan application serial no. 91125114, filed October 25, 2002.

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a method for reducing image noise. More particularly, the present invention relates to a method for reducing scanned image noise and reducing scanned image file capacity.

Description of the Related Art

[0002] A scanner is a machine having a function similar to a camera combined with a Xerox machine, as the scanner can copy an image to a file and then print it out on a printer. In the early days when the scanner was first produced, the price was expensive and only a few people or offices could afford one. Recently, because the manufacturing techniques of optical scan heads are mature and mass production of scanners is now available, the price of scanners has gone down and the scanner has become the next must-have peripheral for mainstream PC users. The scanner market is heating up rapidly.

[0003] The scanner can be classified into several types including the handy scanner, sheetfed scanner, business card scanner, film scanner, drum scanner and flatbed scanner, according to the prices and functions thereof. A flatbed scanner is an opto-electric device capable of converting the printed data on a document into digital

form for processing by the computer. The document that is to be scanned is fixedly placed on a transparent glass plate on the flatbed scanner and a movable scan head moves over the document to make a scan that converts the printed data on the document into digital form. The scan head is optically coupled to a linear array of light-sensing cells such as a charge-coupled device ("CCD"), each cell corresponding to a pixel in the scanned image. Because a flatbed scanner has a simple structure and is easy to use, it has become mainstream among the varieties of scanners.

[0004] When a scanner is used for scanning a document, image noise of the scanned image of the document is produced due to the scanner devices. The image noise may reduce the image quality of the scanned image and make variations compared with the document. A conventional method for reducing image noise is to decrease the color level of the scanned image by a hardware filter, for example, an optical filter. Since the color level of each pixel of the scanned image is averaged in order to average and minimize the image noise, the scanned image quality may be blurred by this method. Another conventional method for reducing image noise is to decrease the color level of the scanned image by a software filter, for example, to set a color scale level as the noise level of a scanned image. But after the color level of every pixel of the scanned image is subtracted by the noise level in order to minimize the image noise, the scanned image quality may also be reduced.

SUMMARY OF THE INVENTION

[0005] Accordingly, one object of the present invention is to provide a method for reducing image noise that does not blur the scanned image after the processing thereof.

[0006] It is another object of the invention to provide a method for reducing image noise that can increase the quality of the scanned image after the processing thereof.

[0007] It is another object of the invention to provide a method for reducing image noise that can reduce the capacity of the scanned image files after the processing thereof.

[0008] To achieve these and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, the method is provided in the following steps. First, the color level scale of a scanned image of a document are reduced by a plurality of bits in order to subtract a noise level from the scanned image. Then the color level scale of all pixels of the image are recombined by a halftone pattern method in order to recover the color level scale. Finally the missing codes of the image are filled out by a bit enhance method. Because the color level scale of the proceeding image are not reduced, the scanned image quality does not be blurred by the method.

[0009] In a preferred embodiment of the invention, a scanned image, composed of a plurality of pixels having a scale of bits, is proceeded by the steps of reducing a plurality of bits of the scale of each pixel in the image, and recombining the scale of each pixel in the image.

[0010] A further embodiment of the invention, after the step of recombining the scale of each pixel in the image, further comprises a step of filling out missing codes of the pixels of the image.

[0011] In a still further embodiment of the invention, the step of reducing a plurality of bits of the scale of each pixel in the image can reduce the scale of each pixel in the image.

[0012] In a still further embodiment of the invention, the step of recombining the scale of each pixel in the image comprises a halftone pattern method.

[0013] In a still further embodiment of the invention, a pattern composed by the halftone pattern method is a matrix pattern, in which the row and column numbers of the matrix pattern are dependent on the number of bits reduced in the step of reducing a plurality of bits of the scale of each pixel in the image.

[0014] In a still further embodiment of the invention, the step of filling out missing codes of the pixels of the image comprises a bit enhance method.

[0015] In another preferred embodiment of the invention, a scanned image, composed of a plurality of pixels having a scale of bits, is proceeded by the steps of reducing a plurality of bits of the scale of each pixel in the image, recombining the scale of each pixel in the image and filling out missing codes of the pixels of the image.

[0016] In a still further embodiment of the invention, the step of reducing a plurality of bits of the scale of each pixel in the image can reduce the scale of each pixel in the image.

[0017] In a still further embodiment of the invention, the step of recombining the scale of each pixel in the image comprises a halftone pattern method.

[0018] In a still further embodiment of the invention, a pattern composed by the halftone pattern method is a matrix pattern, in which the row and column numbers of the matrix pattern are dependent on the number of bits reduced in the step of reducing a plurality of bits of the scale of each pixel in the image.

[0019] In a still further embodiment of the invention, the step of filling out missing codes of the pixels of the image comprises a bit enhance method.

[0020] Accordingly, because the method does not minimize the color level of the proceeding image, the image noise can be reduced without blurring the scanned image and the quality of the image can be increased after the process thereof. And because the

color level of the pixels in the image is subtracted by a noise level, some of the bits of the pixels are removed and the capacity of the image file is decreased.

[0021] It is to be understood that both the foregoing general description and the following detailed description are exemplary, and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] The accompanying drawings are included to provide a further understanding of the invention, and are incorporated in and constitute a part of this specification. The drawings illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

[0023] FIG. 1 illustrates a procedure of the method for reducing image noise of a preferred embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0024] The present invention provides a method for reducing image noise. FIG. 1 illustrates a procedure of the method for reducing image noise of a preferred embodiment of the present invention. Referring to FIG. 1, a scanner 104 is connected to a computer 102 and an image is scanned by the scanner 104. The scanned image is output from the scanner 104 and is processed by steps 106 to 114 in a procedure 100 to reduce the noise of the scanned image.

[0025] Preferably, a scanned image output from the scanner 104 is stored into allocated memory blocks in step 102. The color of every pixel in the scanned image is composed of a red color element, green color element and blue color element. In order to

compose a full-color pixel by the three color elements above, each color element has a 256 scale for a pixel, i.e., each color element is composed by a byte. For example, a pixel may have a red color element of a 210 scale, a green color element of 200 scales and a blue color element of a 190 scale.

[0026] Then the color level scale of the scanned image is reduced in step 104. The color level scale of every color element in all pixels of the scanned image are reduced. For example, if a red color level scale of a pixel is 43 (i.e., 00101011 in binary), the color level scale is then reduced to 40 (i.e., 00101000). The purpose of the step 104 is to set a noise level and to subtract the image from the noise level. Since the setting of the noise level compared with the full-color level is small (i.e., the ratio is about 0~3 to 256), the step 104 does not reduce the color level resolution of the scanned image.

[0027] Thereafter, the color level scale of every pixel of the scanned image processed above is increased by using a halftone pattern method in step 106. The purpose of the step 106 is to compose a color level scale by a pattern with less color level scale. A color level pattern of a pixel in halftone pattern method is composed by a matrix, for example but not limited to, a n x m matrix, in which n and m are positive integers and n is the same or different from m. The number n and m are dependent on the reduced number of bits in step 104, i.e., dependent on the noise level (for example, if the reduced number of bits are 2, the pattern may be a 2 x 2 matrix). The halftone pattern method can recombine the color level scale of the scanned image processed by step 104 to a color level the same as the scanned image stored in step 102. For example, if the color level of the scanned image is 8 bits, after step 104, the color level of the image is 6 bits, and after step 106, the color level of the image is recombined to 8 bits.

[0028] After that, the missing codes of the image processed above are filled out in step 108. The method of filling out the missing code includes, but is not limited to, a bit enhance method. Finally, a noise reduced image is output to the computer 102 and is screened on a monitor of the computer 102 in step 110.

[0029] Accordingly, because the method does not minimize the color level of the noise reduced image, the image noise can be reduced without blurring the scanned image and the quality of the image can be increased after the process thereof. And because every color level scale of the pixel in the image is subtracted by a noise level, some of the bits are removed and the capacity of the image file is decreased.

[0030] It will be apparent to those skilled in the art that various modifications and variations can be made to the structure of the present invention without departing from the scope or spirit of the invention. In view of the foregoing, it is intended that the present invention cover modifications and variations of this invention provided they fall within the scope of the following claims and their equivalents.